



Original article

Anatomical and radiological characteristics in adolescent idiopathic scoliosis with surgical indication[☆]



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ABSTRACT

Objective: This study aims to analyze the anatomical and radiological characteristics of adolescent idiopathic scoliosis patients with surgical indication.

Methods: Retrospective, descriptive study of 100 medical records pertaining to patients included in the group of scoliosis with surgical indication from the years 2008 to 2015. Descriptive statistics were used for statistical analysis.

Results: 28 patients met the inclusion and exclusion criteria, and were selected for the study. The average age was 15.4 (SD ± 1.2 years); in the selected sample, the female/male ratio was 6:1; the kyphosis measured in degrees by Cobb angle between T5–T12 had an average 32.10 (SD ± 13.37); according to the Lenke classification, the most prevalent type was type 2, representing 28.6% of cases.

Conclusion: The mean patient age in the present study was 15.4 (SD ± 1.2 years); the most prevalent type was type 2 in the Lenke classification. There is a need for new anatomical and radiological studies to elucidate the morphological characteristics common in adolescent idiopathic scoliosis patients.

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Características anatomorradiológicas na escoliose idiopática do adolescente com indicação cirúrgica

R E S U M O

Palavras-chave:

Escoliose/anatomia & histologia

Escoliose/radiografia

Adolescente

Resultado do tratamento

Objetivo: Avaliar as características anatomorradiológicas em pacientes com escoliose idiopática do adolescente com indicação cirúrgica.

Métodos: Estudo descritivo retrospectivo de 100 prontuários de pacientes do grupo de escoliose com indicação cirúrgica de 2008 a 2015. A análise usada foi a estatística descritiva.

Resultados: Preencheram os critérios de inclusão e exclusão 28 pacientes e foram selecionados para o estudo. A média foi de $15,4 \pm 1,2$ anos DP; na amostra selecionada, a proporção menina:menino foi de 6:1; a cifose foi medida em graus pelo ângulo de Cobb entre T5-T12 e teve como média $32,10^\circ \pm 13,37^\circ$ DP; segundo a classificação de Lenke, o mais prevalente foi o tipo 2, observado em 28,6% dos casos.

Conclusão: A idade média dos pacientes no presente estudo foi de 15,4 anos; o mais prevalente foi o tipo 2 da classificação de Lenke. Novos trabalhos anatomorradiológicos são necessários para elucidar características morfológicas comuns nos pacientes com escoliose idiopática do adolescente.

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Introduction

Scoliosis is a three-dimensional deformity of the spinal column. The main diagnostic criterion is a spinal curvature exceeding 10 degrees on an anteroposterior view radiograph of the spine.¹⁻⁴ Adolescent idiopathic scoliosis (AIS) is a common condition that affects 0.5-5% of children.⁵ The female:male ratio ranges from 1.5:1 to 3:1, substantially increasing with age.⁵ The co-occurrence between monozygotic twins is higher than 70%.¹

The diagnosis of AIS is made by exclusion, when other causes of scoliosis, such as vertebral malformations or neuromuscular disorders, are excluded.^{1,2} The etiology of AIS is unknown and multifactorial.^{1,5-7} It is very difficult to adequately characterize the morphology of the most important spinal curvatures in patients with AIS, as there is a great variability among individuals.

Some prognostic factors for the progression of the spinal deformity are: thoracic curve or multiple curves, Cobb angle greater than 25 degrees at diagnosis, and delayed skeletal maturation.⁸ The Lenke classification is often used to define treatment in AIS. However, even within the six standard defined curves, there are structural variations within the same kind of curve,⁹ what may interfere with the surgical treatment.

New studies are important to elucidate the prevalent clinical features in patients with AIS in order to assist in the correct anatomical and radiological understanding of the disease. Therefore, this study aimed to assess the anatomical and radiological characteristics of patients with AIS with surgical indication.

Material and methods

This was a retrospective descriptive study of 100 medical charts of patients from the IOT HC-FM-USP scoliosis group,

assessed from 2008 to 2015. The inclusion criteria were: patients with AIS with surgical indication and presence of a panoramic radiograph of the spine in anteroposterior and lateral view. The exclusion criteria were: patients with incomplete registers regarding demographic data, non-walking patients, and those with defined causes for the scoliosis.

The classifications used were Cobb angle and the Lenke classification. Descriptive statistics were used for analysis.

The present study was approved by the Research Ethics Committee of the institution.

The following parameters were assessed: patient age (in years); Cobb angle (measured in degrees), and the first (most cephalad) and the last vertebra (most caudal) of the Cobb angle of the main curve of each patient; Lenke classification of each patient's curve; neutral cephalad, neutral caudal, and neutral apical vertebrae of the main curve; and stable vertebra. The results are shown in charts, tables, sheets, or figures.

Results

After 100 medical registers from scoliosis group patients treated from 2008 to 2015 were retrospectively analyzed, 28 met the established inclusion criteria and were selected. The mean age of patients was 15.4 ± 1.2 years (Fig. 1).

Of the 28 patients analyzed, 24 were girls and four were boys, a ratio of 6:1. Overall, the most prevalent apical vertebra was the T8, in 35.7% of the cases, followed by T9, in 25% of cases. In turn, the most prevalent stable vertebrae were L4 and L3, representing 25% and 21.4% of the cases, respectively (Tables 1 and 2). The most prevalent neutral cephalad vertebra was T5, in 32.1% of the cases, followed by T6, in 25%. The most prevalent neutral caudal vertebrae were L1 and L2, in 35.7% and 21.4% of the cases, respectively (Tables 3 and 4).

Mean kyphosis, measured in degrees by the Cobb angle between T5 and T12, was $32.10^\circ \pm 13.37$ (Fig. 2).

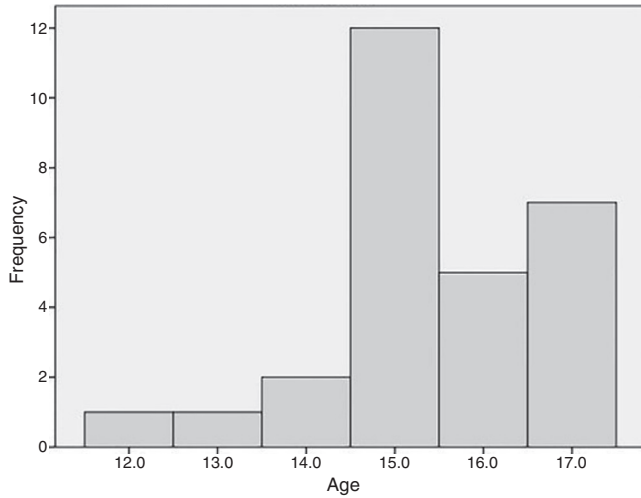


Fig. 1 - Patients age.

Table 1 - Apical vertebra.

	Frequency	Percentage	Valid percentage	Accumulated percentage (%)
L3	1	3.6	3.6	3.6
T10	4	14.3	14.3	17.9
T11	2	7.1	7.1	25.0
T12	1	3.6	3.6	28.6
T6	2	7.1	7.1	35.7
T7	1	3.6	3.6	39.3
T8	10	35.7	35.7	75.0
T9	7	25.0	25.0	100.0
Total	28	100.0	100.0	

Table 2 - Stable vertebra.

	Frequency	Percentage	Valid percentage	Accumulated percentage (%)
L1	2	7.1	7.1	7.1
L2	2	7.1	7.1	14.3
L3	6	21.4	21.4	35.7
L4	7	25.0	25.0	60.7
L5	4	14.3	14.3	75.0
T11	4	14.3	14.3	89.3
T12	3	10.7	10.7	100.0
Total	28	100.0	100.0	

Table 3 - Neutral cephalad vertebra.

	Frequency	Percentage	Valid percentage	Accumulated percentage (%)
T10	1	3.6	3.6	3.6
T11	1	3.6	3.6	7.1
T3	1	3.6	3.6	10.7
T4	3	10.7	10.7	21.4
T5	9	32.1	32.1	53.6
T6	7	25.0	25.0	78.6
T7	5	17.9	17.9	96.4
T9	1	3.6	3.6	100.0
Total	28	100.0	100.0	

Table 4 - Neutral caudal vertebra.

	Frequency	Percentage	Valid percentage	Accumulated percentage (%)
L1	10	35.7	35.7	35.7
L2	6	21.4	21.4	57.1
L4	1	3.6	3.6	60.7
L5	1	3.6	3.6	64.3
T11	5	17.9	17.9	82.1
T12	5	17.9	17.9	100.0
Total	28	100.0	100.0	

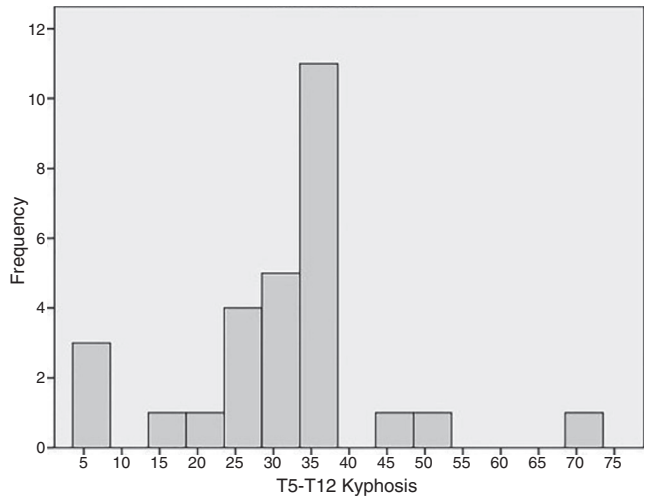


Fig. 2 - T5-T12 kyphosis.

According to the Lenke classification, the most prevalent type of AIS in this study was type 2, observed in 28.6% of the cases, followed by type 4, in 25.1%. Fig. 3 shows an example of the measurements used in the study of a patient with AIS.

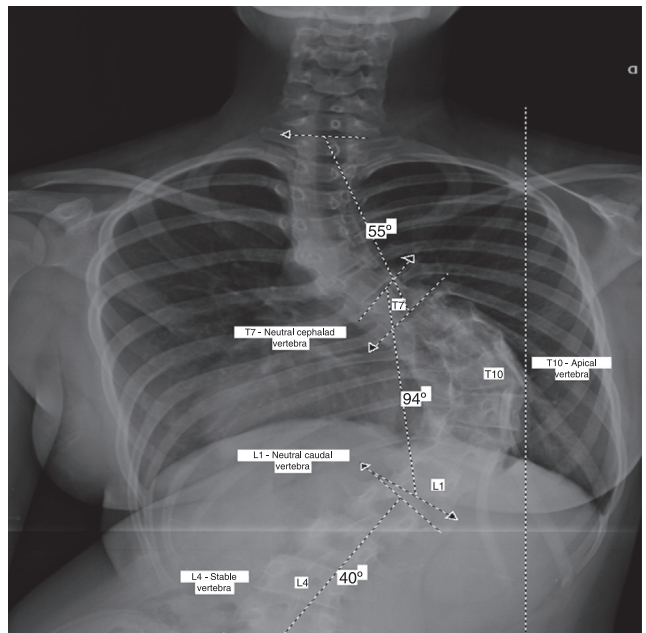


Fig. 3 - Example of measurements in AIS.

Table 5 – Lenke classification.

	Frequency	Percentage	Valid percentage	Cumulative frequency (%)
1 – A	1	3.6	3.6	3.6
1 – B	1	3.6	3.6	7.1
1 N A	2	7.1	7.1	14.3
1 N B	1	3.6	3.6	17.9
1 N C	1	3.6	3.6	21.4
2 – C	1	3.6	3.6	25.0
2 N A	3	10.7	10.7	35.7
2 N B	3	10.7	10.7	46.4
2 N C	1	3.6	3.6	50.0
3 + C	1	3.6	3.6	53.6
3 N B	1	3.6	3.6	57.1
3 N C	3	10.7	10.7	67.9
4 + A	1	3.6	3.6	71.4
4 + B	1	3.6	3.6	75.0
4 N A	1	3.6	3.6	78.6
4 N B	1	3.6	3.6	82.1
4 N C	3	10.7	10.7	92.9
6 N B	1	3.6	3.6	96.4
6 N C	1	3.6	3.6	100.0
Total	28	100.0	100.0	

No patients were classified as type 5 in the sample selected (Table 5).

Discussion

The present study aimed to evaluate the radiographic parameters of the curves and epidemiological data of patients with scoliosis in the surgical waiting list of this institution. In the present study, only the radiographic method for evaluation of the images, which remains the gold standard for the diagnosis of scoliosis, was used. Regarding the results, previous studies indicated that the prevalence and severity of this disease are higher in girls, and that this relationship increases with age.¹⁰ In the present series, a higher prevalence of the disease in girls was observed, at a ratio of 6 girls:1 boy, in agreement with the literature.

Among the numerous classification systems for AIS, the King and Lenke classifications are noteworthy. In 1983, Howard King presented his classification system, in which five types of curve were described. His work defined for the first time some concepts that are widely used nowadays, such as stable vertebra and structural or compensatory curves.¹¹ However, a low inter- and intraobserver agreement was reported for that classification.^{12,13} In 2001 Lenke et al.¹⁴ published a new classification system for AIS defining six types of curve; for the first time, the sagittal plane deformity of the spinal column was taken into account for AIS classification. A higher inter- and intraobserver agreement was observed for this new classification when compared with King's.¹⁴

In the present study, only the Lenke classification was used, due to its higher interobserver agreement, aiming to minimize bias from errors in the classification of types of curves of patients. In the present sample, Lenke classification type 2 curves were the most prevalent; however, the literature features type 1 as the most common pattern.¹⁵

The main treatment choices for AIS are the use of orthoses and surgery. The most common orthoses used in the treatment of AIS with demonstrated efficacy are the Milwaukee vest and thoraco-lumbo-sacral orthosis.^{16,17} The main surgical indication in AIS is a thoracic curve of 50° or more, measured by the Cobb angle during skeletal maturation.¹⁸ Therefore, the correct classification and measurement of the degree of scoliosis is paramount in determining the correct treatment of the condition.

There are no recent studies in the literature that indicate the distribution of anatomical or morphological characteristics in patients with AIS. Thus, the present study has contributed to elucidate the prevalence of these findings in the cases of AIS in our institution, in order to more clearly identify what type of patient is being treated; with the correct diagnosis, a better treatment can be proposed.

Recent studies have shown that pelvic incidence may be relevant as a compensatory or causal factor in the development of scoliosis.¹⁹ These parameters were not analyzed in this study, and may prove important in future research. Furthermore, due to the retrospective characteristic of the study, a lack of data or recording issues were observed in various charts. Of the 100 records analyzed, only 28 met the inclusion and exclusion criteria, a fact that has undoubtedly affected the findings of the study. This study should not be generalized to other populations, as the selected sample comprised patients from an outpatient clinic who already had had surgical indication, a fact that, by itself, greatly impacts the findings.

Conclusion

In the present study, the mean age of patients was 15.4 ± 1.2 years. A ratio of 6 girls:1 boy was observed. The mean kyphosis, measured in degrees by the Cobb angle between T5 and T12, was 32.10° ± 13.37. According to the Lenke classification, the most prevalent type of AIS in this study was type 2, observed in 28.6% of the cases, followed by type 4, in 25.1%. No patients were classified as type 5 in the sample selected (Table 5).

New anatomoradiological studies are needed to elucidate the common morphologic features in patients with AIS.

Conflicts of interest

The authors declare no conflicts of interest.

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